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ABSTRACT

This paper is based on the reflections of a distance education (DE) mathematics instructor at Pellissippi State Technical Community College in Knoxville, Tennesee. In this DE classroom, 30 students were present with the instructor at the main campus, 8 students at a remote campus in Blount County, and 6 students in Knoxville. The link between the classrooms was made by Instructional Television Fixed Service technology, which connected the classrooms via two-way audio, but only one-way video. The typical class period was divided into two parts: a lecture delivered via a multimedia program using Macromedia Director; and discussion of homework problems that were solved in class using an overhead camera. Problems encountered in the classrooms included: (1) the teacher had to attend to the needs of students he couldn't see; (2) multimedia delivery involved extensive planning; (3) students at remote campuses were unable to see and hear everything that occurred in the main campus classroom; (4) remote students very rarely interacted without being asked; (5) student-to-student interaction was non-existent; (6) questions asked in the main classroom had to be repeated by the teacher so the remote classrooms could hear; and (7) distance students needed to take more responsibility for their own learning and overcome their intimidation of using microphones to interact with the class. (KP)

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ED 385 332

INSTRUCTIONAL MULTIMEDIA IN THE MATH CLASSROOM AND BEYOND

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Introduction

Distance learning is a broad category of education that strives to overcome the problem of teacher and learner being separated by some physical distance. I have been very interested in analyzing the distance learning environment since I was first asked to teach in such a setting for the first time in the fall of 1993. It seems to me that this distance learning environment is important to study and understand since in the future it is not difficult to imagine that its presence might contain a significant portion of the educational community, considering the infusion of recent communications technologies. Given current expectations for encouraging lifelong, continuous learning, it seems logical to consider approaches toward the design of distance learning instruction which will engage learners as active participants in the generation of learning (Wagner & McCombs, 1995). The distance learning classroom in many ways can be compared to the traditional classroom and considered similar, but there appear to be significant differences that warrant considerable reflection on the part of the teacher (Wolcott, 1995).

The Distance Classroom

The analysis in this paper is based on video recordings taken from a liberal arts mathematics course that I taught during the spring semester of 1994 at Pellissippi State Technical Community College in Knoxville, Tennessee. Approximately 70% of the student population were students that had been required to take at least one semester of developmental mathematics prior to enrolling in the course. The students were predominantly nursing, video production technology, and social work majors; however, other majors included history, English, and music.

This particular distance learning classroom was a unique one since there were 30 students physically in the classroom with me at the main campus, 8 students at a remote campus in Blount County, Tennessee, and 6 students at a remote campus in Knoxville, Tennessee. If you have not had the experience, it is hard to imagine how difficult it is to attend to the needs of three classrooms simultaneously, especially when you can not even see some of your students. The distance from the main campus to the remote campuses is about 30 miles and 20 miles, respectively, as shown in Figure 1 below.

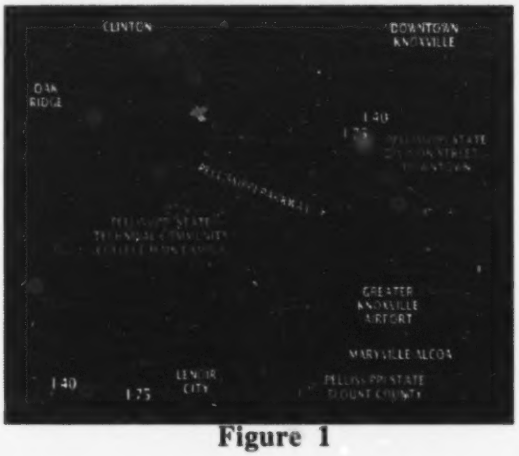

Figure 1

The link between these classrooms was made by way of ITFS (Instructional Television Fixed Service) technology. A major consequence of using this technology was the fact that it connected the classrooms via two-way audio, but only one-way video. Communication

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was inhibited by the fact that I was unable to see the gestures and facial expressions of the students at the remote campuses. The students at the remote campuses had similar difficulties in that even though they had a video display, they were still unable to see and hear everything that occurred in the main campus classroom.

The Distance Teacher and Instructional Approach

I was completing my second year of full-time teaching at the college level and had completed no formal courses in a college of education prior to teaching this course. I had completed about 60 hours of graduate level mathematics courses, and being a product of my environment, my background for teaching was very traditional from a teacher education point of view. However, I had been very involved in the use of technology in instruction by experimenting with symbolic and numeric computation packages, graphing calculators, and most importantly for this study, multimedia.

The typical class period was divided into two major divisions. I generally had control during what might be called the lecture portion of the class period. These lectures were delivered via a multimedia program that I had written using Macromedia Director as the authoring tool. Macromedia Director is a program that can be used to create royalty-free standalone applications that can include professional animations and transitions. However, the software is very expensive and has a steep learning curve. The main menu of this application is shown in Figure 2 below. Portions of this multimedia program were

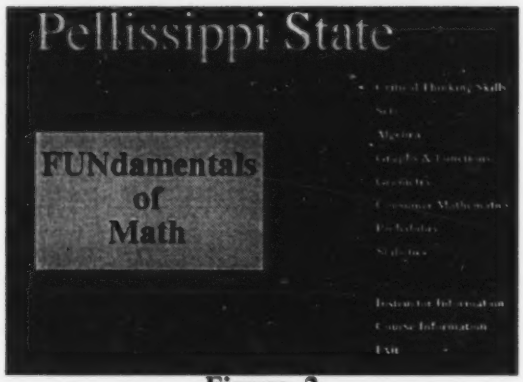

Figure 2

designed and used in two very distinct ways. Part of the program was similar to a glorified page turner for the presentation of material, but other portions were designed to actively engage students to participate in the class discussions and the social construction of mathematical knowledge. Teaching a distance learning course requires planning at a level above and beyond that of a traditional classroom setting. Coupled with the fact that the method of delivery involved the use of multimedia, the planning involved in teaching this course was tremendous. A consequence of this planning might have been that the lecture periods became too rigid, not allowing for excursions that might have been introduced by prompting student interaction. The point made by Voigt (1994) that "because 'a teacher is not safed against the student's creativity' (Bauersfeld, personal communication) the students can originally contribute to the theme so that the theme does not become a representation of the mathematical content which the teacher intended to establish," is even more profound in this distance learning context. An obvious problem here is that distance learning technology does not lend itself well to changing methodology once a class session has begun. So, there appears to be even a greater need for distance teachers to stay with the "prepared script" and thus encourage traditional instruction.

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The remaining class time involved discussion of homework problems and additional problems that were solved in class by using an overhead camera that captured my handwriting from a tablet. Since these students were non motivated mathematically and were possibly intimidated by the communications technology, I believed that the use of multimedia could have possibly been used to mediate between the students fears, beliefs, and their mathematical learning. Again, it wasn't the multimedia that was the important factor, but how it was used in the classroom.

Classroom Interaction and Social Norms

The expectations regarding social interaction of the students in the class had been developed on the basis of their prior experiences in traditional classrooms for many years. The typical interaction pattern in this distance learning classroom was not unlike that described in Mehan's (1979) analysis where it was indicated that a typical interactional sequence begins with a teacher's question, followed by a student's response, and concludes with the teacher's evaluative response. As noted by Cobb, Yackel, and Wood (1993) in reference to Bauersfeld (1980) and Voigt (1985), students are typically steered or funneled toward an officially sanctioned solution method or answer during these dialogues.

By observing classroom video, a search was made for evolving patterns and regularities that occurred within the classroom social interactions in order to identify classroom social norms. An attempt was made to compare the interaction in each division of the class periods that were mentioned earlier. Also, the interaction of students on the main campus was compared with the remote campus interaction. According to Cobb, Yackel, and Wood (1993), these patterns are, for the most part, outside the conscious awareness of both the teacher and the students and are repeatedly reconstructed in the course of interactions (Bauersfeld, 1980; Voigt, 1989). In the following passage, Cobb, Yackel, and Wood (1993) summarize this position.

> In other words, the patterns consist of coordinated sequences of routine individual actions, and at each occurrence, the development of a pattern begins anew -- the enactment and the construction of the pattern are synonymous. Thus, although the teacher and students do not have a "blueprint" of the interaction pattern, each knows how to act appropriately in particular situations. It is these patterns in social interactions that reveal the largely implicit social norms negotiated by the teacher and students, the norms that constitute the social reality within which they teach and learn mathematics.

Throughout the analysis I will draw upon my personal experiences as a distance education teacher and responses from student surveys that I conducted at the conclusion of the semester to complement the actual classroom video. Schon (1983) suggests that in reflection, teachers try to make sense out of uncertain and unstable situations. To analyze what goes on in a distance classroom, the teacher should reflect on the context, the learners, and the methods and procedures they employ (Wolcott, 1995).

The following excerpt was taken from a class period that involved the use of multimedia (Jeopardy) in an attempt to involve students on all three campuses in a review session. The notation DS is used to represent a student at a distant campus, S is used to represent a student at the main campus, and T is used to represent the teacher.

> **T**: Let's see who we've got this time. Jacob again. Would you like to try again or pass?
> **DS**: I'll go again.
> **T**: You'll go again, alright. Take a choice between Sets #1, Sets #2, and Thinking Skills.

DS: Sets #1.
T: Sets #1 for $100, alright. The answer is, this set of elements, this is the set of elements that belong to set A and set B. The key work here is and. Any ideas?
DS: Is it universal?
T: What is the universal set? Close.
DS: I knew that was wrong.
T: OK, let's go on and get somebody else, see if they can nail this one down. William, is William here?
S: (Inaudible.)
T: He wasn't here the first time and he's not here this time, OK. Alright, we'll go on to Darlene. Would Darlene like to answer this or pass?
S: What is the, what is union?
T: What is the union she says. Remember and, if it's in A and B it's where? Think of set A and set B.
S: Intersection?
T: It would be the intersection, right. If it's in A and B then it's in the football shaped region or intersection. I helped a little, but that's OK this is practice. Right? This is the set of elements that belong to set A and set B. What is the intersection, Alex, or Andy?
S: (Inaudible.)
T: Yeah, the universal set is the set of all elements under consideration, right. But these are elements that are in A and B. There could be stuff not in A and not in B that are in the universal set as well. Right?

One taken-as-shared norm that appears to exist during this portion of the class period is that students are expected to respond, even if they are not sure that they have the correct answer. Every member of the classroom community is expected to participate. The atmosphere seems to be that student responses are valued, and if necessary and deemed appropriate, the teacher will guide or funnel the student to the correct response. Throughout the course of this interaction, the teacher does most of the talking and explaining. The nature of the task is partially responsible for the brief responses. Notice that the interaction always takes place through me, the teacher.

A very important rule that I tried to get established all semester without success was for the students at the main campus to touch their microphones before speaking. Figure 3

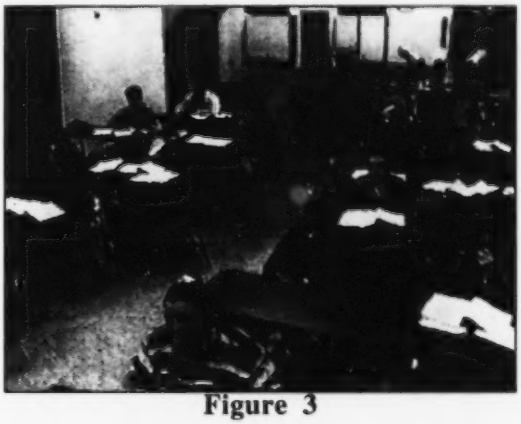

Figure 3

is a photo of the classroom at the main campus. There was a microphone (a black box in Figure 3) in the middle of each table that each pair of students shared. What became the

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norm was that if I called on a student with a raised hand, I was usually able to interrupt the student and ask them to turn on their microphone. What some student's learned was that if they simply responded without first raising their hands that I would simply repeat what they had said. It was the case however that on several occasions I simply forgot to repeat their responses by getting caught up in the conversation.

The video tapes that were used for this analysis were actual broadcast tapes, so if the student's failed to use their microphones, their responses weren't heard by the remote classroom students, nor were they recorded on video. Being in the position of analyzing the video tapes makes me even more aware of the difficulties faced by the students in the remote classrooms. There were some good discussions that I couldn't transcribe since the student's comments were inaudible. A major consequence of this breech of the teacher intended classroom rule was that the remote campus students occasionally received an incoherent conversation which could conceivably cause some students to become frustrated and completely tune out the entire conversation. In such a situation, it would have been difficult to imagine that the remote campus students could contribute to the classroom discussion.

It was very rare for a remote campus student to interact without explicitly being asked for a response. This lack of interaction is not surprising given the situation in which these students were placed. These students are faced with psychological, social, and technical obstacles that can be quite overwhelming. Reflection on this fact by placing myself in the position of distance student has been quite a learning experience. To their disadvantage, these students were forced to assert themselves as active participants in the classroom discussions or become silent observers. Since these students were unseen and usually unheard, it was easy for them to become an invisible part of the classroom community. This argument is supported by distance student responses to the question: "How is student interaction different in the distance learning environment than in a traditional classroom?" Some of the responses were as follows:

- § You sometimes feel embarrassed to talk.
- § I don't particularly like to use the microphones, but that's my problem, I just don't ask questions.
- § I like to ask questions, it's harder when you can't just raise your hand.
- § One seems to become more closely relaxed to others because you have the opportunity to talk around yourself.
- § Within the classroom, there is good interaction however we do not get a chance to see or talk with other students.
- § Students TALK while the TV is on if they already understand the concept. Some are really bad at talking and inhibiting other students from hearing effectively.

Since there was no video available from the remote campuses, the student responses to this survey were the only means for addressing the social norms within the distance classrooms. The students appeared to have felt more relaxed in "their" classroom, not fully realizing that it was part of a larger classroom in which they should have also felt relaxed. The students were forced to be more in charge of their own learning by ignoring the nonproductive noise and talk at their remote campus.

Conclusions

Within the distance learning environment that includes cameras, microphones, and computers, communication is made possible between teachers and students where it once was not, but at the same time this technology also has the potential to inhibit classroom interactions. However, reflective distance teachers can overcome some of these difficulties by placing themselves in the situation of the distance learner. The distance learning

environment is very unique and requires considerable reflection. A distance teacher can't expect the same pedagogical principles that were successful in a traditional classroom to be successful without adjustment in the distance learning environment.

There are several variables to consider when analyzing the interaction in this distance learning classroom. There were three distinct modes of classroom teaching methodology, along with the two types of physically separated classrooms (main and remote). However, there were some common patterns. The obvious one being that student to student interaction was nonexistent, in fact, all interaction occurred directly through me, the teacher. This is a characteristic of what Richards (1991) refers to as "school math," where students don't communicate directly with one another, and in fact never address one another. The teacher in "school math" remains in control and speaks every other turn. This characteristic is very prominent throughout the entire semester of transcripts. Therefore, I would classify the classroom in this study to be a very nontraditional traditional classroom. It was nontraditional in the sense of the method of delivery and the use of communications technology, but it was very traditional in the sense of student to teacher interactions.

The social norms for participating and contributing to classroom discussions seemed relatively stable within each of the three major types of classroom activity. On a general level, the patterns of interaction seemed to fit with the notion of what Voigt (1994) refers to as an elicitation pattern. Typically the teacher posed a question and the students gave responses for which the teacher responded either with another question or with an evaluation.

I had initially wanted to impose the use of microphones by students at the main campus, but the students were able to implicitly negotiate this by responding without first being recognized by the teacher, whereby I usually repeated the students' comments over the system so that the remote campus students would be able to hear them. The microphone technology turned out to be much more of an inhibitor to classroom interaction than originally anticipated. The remote campus students appeared to be the most affected however.

In order to be successful in the distance learning classroom, teachers have to force themselves to attend to the needs of the students at remote campuses. This is very different from a traditional classroom environment, since the students can not be seen by the teachers. The teachers must also overcome the constraints that they feel are placed on them by the technology.

Unfortunately, the distance students must take more responsibility for their own learning in the distance environment setting than in the traditional setting. The distance students must also overcome the intimidation of using the technology to interact with the class on a voluntary basis.

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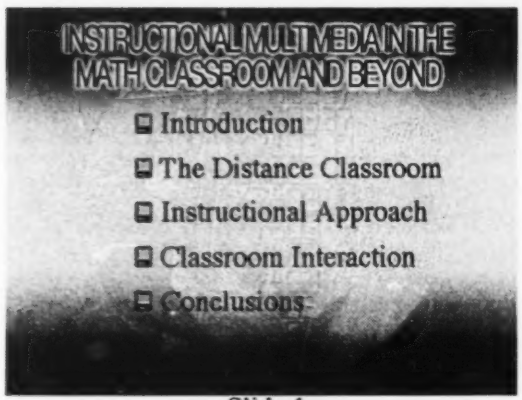
Presentation Slides



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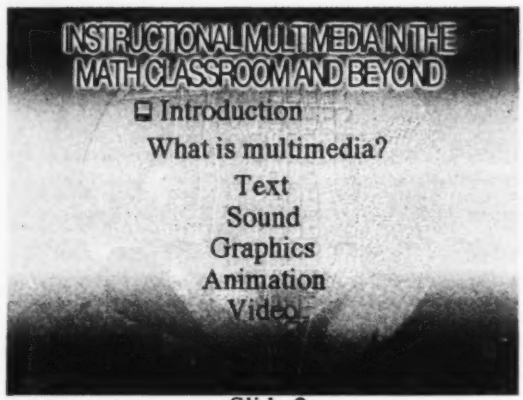

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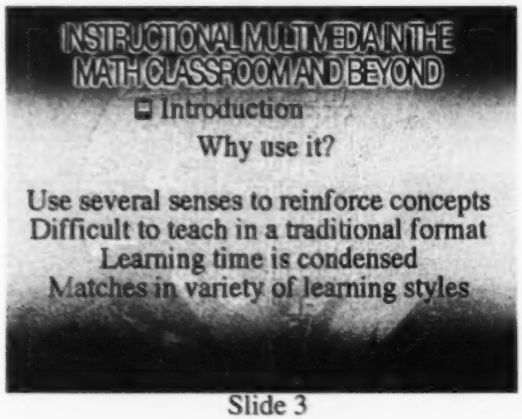
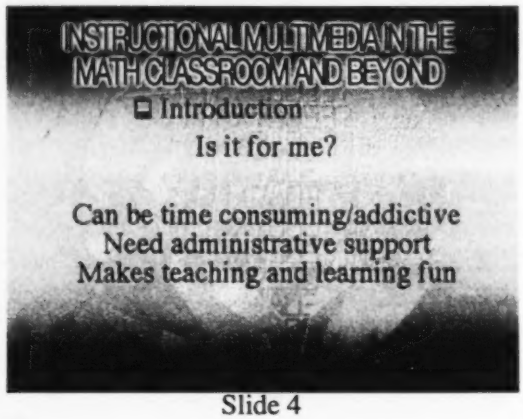

INSTRUCTIONAL MULTIMEDIA IN THE MATH CLASSROOM AND BEYOND
Introduction
Why use it?
Use several senses to reinforce concepts
Difficult to teach in a traditional format
Learning time is condensed
Matches in variety of learning styles

Slide 3


INSTRUCTIONAL MULTIMEDIA IN THE MATH CLASSROOM AND BEYOND
Introduction
Is it for me?
Can be time consuming/addictive
Need administrative support
Makes teaching and learning fun

Slide 4

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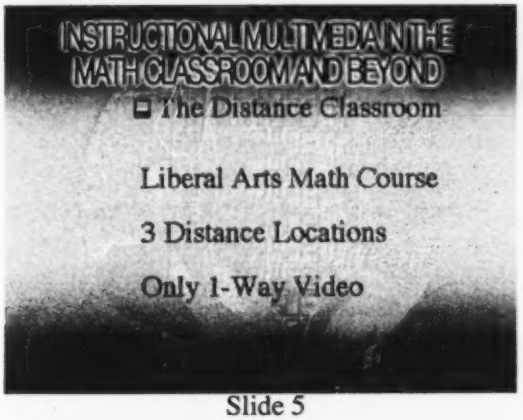
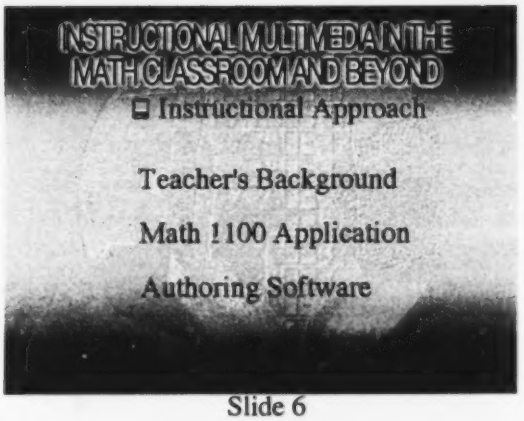

INSTRUCTIONAL MULTIMEDIA IN THE MATH CLASSROOM AND BEYOND
The Distance Classroom
Liberal Arts Math Course
3 Distance Locations
Only 1-Way Video

Slide 5



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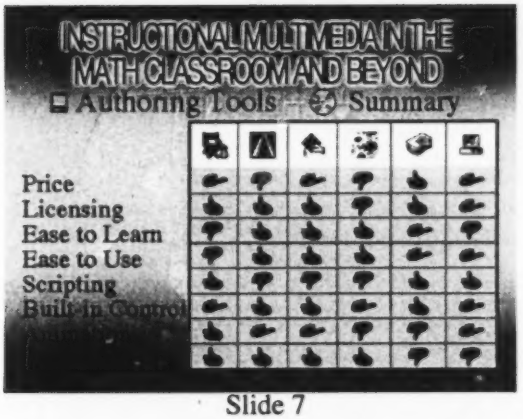

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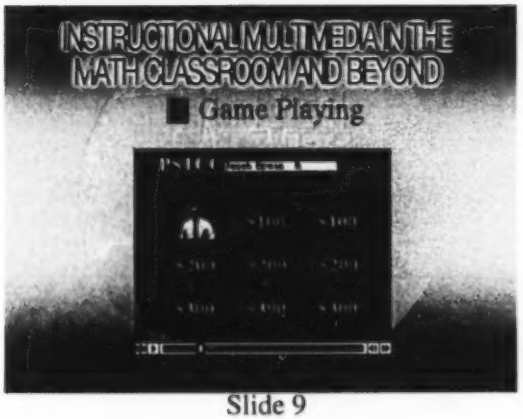

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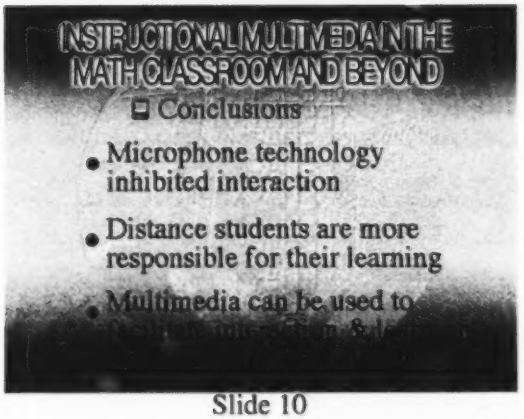
INSTRUCTIONAL MULTIMEDIA IN THE MATH CLASSROOM AND BEYOND
Conclusions
Microphone technology inhibited interaction
Distance students are more responsible for their learning
Multimedia can be used to

Slide 10

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